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Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

THE SONG REMAINS THE SAME:
UNITED STATES MARINE CORPS AND V/STOL

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AUTHOR: Major Michael A. Coolican

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Mentor: Dr. Mark Jacobsen

Approved: _____

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Mentor: Lieutenant Colonel Scott Slater

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EXECUTIVE SUMMARY

Title: The Song Remains the Same: United States Marine Corps and V/STOL

Author: Major M. A. Coolican, United States Marine Corps

Thesis: The reasons why the Marine Corps wanted V/STOL change as the decades progress from the post World War II era to the mid to late Vietnam era, however, what does not change are the two true unique abilities that a fixed-wing, jet powered, V/STOL platform brings to a service: basing flexibility and Close Air Support responsiveness.

Discussion: Beginning with General Roy Geiger's observations of the Bikini Lagoon atomic testing in 1946, the Marine Corps recognized the need for dispersal on the battlefield. In 1957, General Pate, Commandant of the Marine Corps, in a letter to the Chief of Naval Operations, codified the course Marine aviation would chart to achieve the goal of dispersal: an all V/STOL force. Throughout the late 1950s until the mid 1960s, all Armed Forces of the United States as well as many of her allies pursued a fixed-wing V/STOL aircraft. However, due to technical and fiscal difficulties all services and countries backed out on the project with the exception of the USMC and Great Britain. The USMC based their need for V/STOL on two arguments: basing flexibility and Close Air Support responsiveness. They used varied approaches throughout the years to explain why V/STOL was the correct tool to achieve these goals, but the Corps always remained consistent on the two central themes.

Conclusions: The Marine Corps' consistent message on the importance of V/STOL has allowed the Corps to successfully operate a V/STOL aircraft for more than 30 years and has positioned it to acquire the next generation V/STOL aircraft: STOVL Joint Strike Fighter. Additionally, V/STOL has allowed the Marine Corps to remain relevant in the current war on terrorism by negating the lack of bases and being flexible enough to deploy anywhere in the world for sustained operations.

Table of Contents

	<i>Page</i>
DISCLAIMER	2
EXECUTIVE SUMMARY	3
CHAPTER 1: Introduction	5
CHAPTER 2: V/STOL Genesis	11
CHAPTER 3: Basing Flexibility	18
CHAPTER 4: Close Air Support Responsiveness	30
CHAPTER 5: 30-Year Report Card	38
CHAPTER 6: Conclusion	43
BIBLIOGRAPHY	47

CHAPTER 1: INTRODUCTION

Because of the AV-8B, more Marines came home and fewer received Purple Hearts.

Col Rusty Jones, USMC
House Armed Services Committee¹

In August 1991, Iraq invaded the small nation of Kuwait and evoked a massive response from the world. Forces poured into the Persian Gulf region as the coalition, led by the United States, prepared to eject Iraqi forces. Among the first aircraft sent to the theater were United States Marine Corps AV-8B Harriers. The Harrier was based forward at King Abdul Aziz Air Base, a previously abandoned airstrip with no facilities, and aboard the *U.S.S. Nassau* (LHA-4) and the *U.S.S. Tarawa* (LHA-1). The eventual 66 land-based and 20 sea-based Harriers flew 3,359 sorties while attacking 2,585 targets with a loss of five aircraft and two pilots during the conflict.² At the conclusion of the war, General Norman Schwarzkopf "...highlighted the Harrier as one of six significant weapons systems of the Gulf War. Secretary of

¹Roy Braybrook, *Harrier: The Vertical Reality* (Hong Kong: The Royal Air Force Benevolent Fund Enterprises, 1996), 127.

²Gulf War Air Power Survey; Vol. 4 (Washington, D.C.: U. S. Government Printing Office, 1993), 60.

Defense Richard Cheney further narrowed that selection to three, including the Harrier."³

Two decades prior to Desert Shield/Desert Storm, the Harrier saw its first combat action with the United Kingdom during the Falklands War. Despite overwhelming numbers of Argentinean aircraft and despite the fact that Britain was operating more than 8,000 miles from home, 28 Royal Navy Sea Harriers and 8 Royal Air Force (RAF) GR3 Harriers⁴ flew over 1,650 sorties accounting for 31 air-to-air kills while not losing a single aircraft in air-to-air combat.⁵ The Harriers enabled the United Kingdom to operate in the seas around the Falklands—although not without risk—and for the Royal Marines to re-claim the islands for Britain.

WHY V/STOL?

Currently, the United States Marine Corps has over 175 AV-8Bs and has been flying the Harrier since the early 1970s. The Harrier is now and always has been the only Vertical/Short Takeoff and Landing (V/STOL) jet aircraft in the United States inventory. This paper will explore the reasons why the Marine Corps pursued V/STOL, at first with the other services, but ultimately on its own; what role the Marine Corps originally intended a V/STOL aircraft to

³Braybrook, 127.

⁴The Royal Air Force GR3 was very similar to the USMC AV-8A.

⁵Max Hastings and Simon Jenkins, *The Battle for the Falklands* (New York: W. W. Norton and Company, Ltd., 1983), 316-317.

play; and finally how the Harrier has fulfilled the expectations. As will be covered, the reasons why the Marine Corps wanted V/STOL vary as the decades changed from the 1950s to the 1970s when the Harrier entered service. However, what does not change are the two true unique abilities that a fixed wing, jet powered V/STOL platform offers to a service: basing flexibility and Close Air Support (CAS) responsiveness.

NAVY VERSUS MARINE CORPS

When considering the length the Marine Corps would go to acquire a V/STOL aircraft, an understanding of Marine Corps aviation procurement is necessary. Because the Marine Corps is part of the Department of the Navy, the Marines operate under different rules than some of the other services. One unique aspect is that the Navy "owns" all Marine Corps aviation money. That is, when Congress appropriates funds each fiscal year, the Marine Corps receives no funding line for purchasing, maintaining or operating aircraft. Instead, all of the required funds are in Navy funding lines. Although all services are continuously competing for their portion of the oft-times anorexic defense budget, the Marines are faced with the additional challenge of fighting internally against Navy aviation requirements. As a result of this, the Marine

Corps is forced to consider very carefully whether or not to attempt to purchase an aircraft by itself or if it should piggyback on an existing or proposed Navy program. Evidence of this is seen with the Marines falling in line with the Navy and purchasing the F/A-18, A-6, EA-6, and many others. Due to the size of the Corps, the numbers of aircraft it needs is very small. When acquiring a weapons system there is a concept called Economies of Scale, defined by the Defense Acquisition University as:

Reductions in unit cost of output resulting from the production of additional units stem from increased specialization of labor as volume of output increases; decreased unit costs of materials; better utilization of management; acquisition of more efficient equipment; and greater use of by-products.⁶

Therefore, if the Marine Corps strikes out on its own and attempts to procure a unique major weapons system, it is going to be faced with higher costs than if it combined with another service simply because of the fewer numbers of units produced.

V/STOL ADVANTAGE

In the years following the end of World War II and up until when the AV-8A was procured, the Marine Corps gave many different reasons why V/STOL was very important. The Marine Corps leadership argued that, following the Bikini

⁶Defense Acquisition Deskbook Defense Systems Management College-Glossary, "Defense Acquisition Acronyms and Terms," URL: <web2.deskbook.osd.mil>, accessed 22 November 2001.

Lagoon atomic testing, large military formations were obsolete because of their vulnerability to atomic attack and therefore large airbases with thousands of feet of runway were obsolete. They stressed the importance of having fixed-wing aircraft on non-aircraft carrier naval ships. This would give the Marines the ability to have CAS even when the carriers were off on another mission or the threat was too great to risk the carrier. By the 1960s, the Marine Corps pointed out that airbases were vulnerable to terrorist and surprise attacks. They even went so far as to use scare tactics and point out, during 1969 Congressional testimony, that in the past decade the "Red Menace" was advancing in the field of V/STOL technology and that the United States needed to keep pace. When Senator Thurmond asked why the Marine Corps needed to buy the British Harrier immediately, General Chapman replied, "To delay V/STOL evaluations until U.S. industry could produce a suitable aircraft would place the United States even further behind Russia in acquiring a tactical V/STOL capability."⁷

The argument that carried the most weight, especially within the Marine Corps itself, was the CAS argument.

⁷U. S. Congress, Senate, *Authorizing Appropriations for FY 1970 for the Department of Defense, Senate Hearings*, 91st Cong., 1st sess., 1969, 171.

Because the Marine Corps is a small, light force, it relies on CAS vice heavy artillery. In order for CAS to be effective, it must be responsive. If CAS cannot be delivered when the ground forces need it, it is irrelevant. The Harrier, its proponents argued, was the perfect CAS platform because it could be based up front with the ground troops and could provide extremely timely CAS. In a 1977 press briefing, Deputy Chief of Staff/Aviation, General Miller summed up the importance of CAS responsiveness:

We have found in three wars—World War II, Korea and Vietnam—that any unplanned ground conflict is generally decided within the first 30 minutes. If you cannot get to the men on the ground within 30 minutes you might as well have stayed at home. You’ve lost the battle. With the Harrier, we have brought our response time down to 10-12 minutes.⁸

The bottom line of all of these arguments was the same; a V/STOL aircraft brought with it the basing flexibility and CAS responsiveness that would give the Marine Corps the ability to support ground operations in a number of different ways.

⁸Lt Gen T. Miller, USMC, Deputy Chief of Staff/Air press conference, Washington DC, 13 Sep 1977, transcript (Marine Corps Historical Center, Archives, Aircraft: Harrier AV-8A and AV-8B General Information).

CHAPTER 2

V/STOL GENESIS

Before discussing the reasons why the Marine Corps wanted a fixed-wing, jet powered V/STOL aircraft, a brief understanding of the history of V/STOL development and thought is required. There are two paths to be considered: the technical development and the conceptual development within the United States Armed Forces and Allied countries. For the United States Marine Corps, the "official" genesis of the search for a fixed-wing, V/STOL aircraft began in 1957 when Commandant of the Marine Corps, General Pate, sent a letter to the Chief of Naval Operations informing him that the Marine Corps had a goal of an all V/STOL aviation force.⁹

TECHNICAL V/STOL DEVELOPMENT

The concept of vertical flight had been considered for many years and by the late 1940s had come to fruition with the helicopter. However, with the advent of jet-powered aircraft, many envisioned a jet fighter aircraft with vertical capability. Unfortunately, in the 1950s, when these ideas were being considered, technology could not fulfill the desires of the inventors. The difficulty they

⁹The 1957 letter is referenced in different articles as well as by a number of people familiar with the Harrier program. However, primary source material from the 1950s and 1960s referencing V/STOL and the Marine Corps was not found in the Marine Corps Research Center Archives, Quantico or in the MCHS Archives at the Washington Navy Yard.

faced was finding enough power to keep the aircraft aloft while in vertical flight. In order to fly, an aircraft must be kept airborne in one of two ways, either by aerodynamic lift produced by airflow over a cambered surface—a wing—or by thrust from an engine. If an aircraft is going to be kept airborne using only its engine, then the thrust produced must be greater than the weight of the aircraft. In the 1950s, early jet engines did not produce enough thrust for this concept, and all ideas that used more than one engine were too complicated for practical military application.¹⁰ Fortunately, in the mid 1950s a series of events occurred that would ultimately solve this dilemma. A design by Frenchman Michel Wibault; an engine built by Englishman, Sir Stanley Hooker; and funding provided by Colonel Johnny Driscoll, U. S. Air Force, were the genesis of the modern Harrier. This design used a jet engine that blew air out of four nozzles that could be rotated in flight.¹¹ Interest in the concept continued to grow, not only in England and the United States, but also in other North Atlantic Treaty Organization (NATO) countries, culminating in the mid 1960s with the Tripartite Evaluation Squadron comprised of the U. S., British and

¹⁰ Braybrook, 13.

¹¹ Lance Anderson, "Piggyback Technology," *U. S. Naval Institute Proceedings*, vol. 112 (November 1976): 54.

German governments in a collaborative effort. This effort successfully built and flew a true V/STOL jet aircraft. However, there existed one major drawback in that the developers attempted vainly to overcome: speed. Both the British and the U. S. wanted a supersonic aircraft and when it could not be produced, the U. S. Air Force and Navy lost interest in the project. Fortunately, the United Kingdom pressed forward with the project and in 1967 the RAF signed a production contract for 60 GR1 Harriers.¹²

CONCEPTUAL V/STOL DEVELOPMENT

In order to field a new technology, there must exist a desire and a potential military requirement for the concept within one or more of the services. In the 1950s, the conventional military wisdom was focused on the tactics of dispersion due to the proliferation of atomic weapons.¹³ At that time there was much discussion amongst the services about the value of a high performance, fixed-wing, V/STOL aircraft that could survive a nuclear attack by dispersing throughout the battlefield. In 1957, future Commandant of the Marine Corps, R. E. Cushman, who had written before on the subject, wrote an article in the *Marine Corps Gazette* opining on the need for dispersion and minimizing reliance

¹²Braybrook, 43.

¹³The idea of the nuclear battlefield will be explored in more depth in the following chapter.

on fixed installations on the nuclear battlefield (Feb 1957). This was a popular topic of the time, even prompting a November 1960 *Gazette* article by J.F.C. Fuller on the need for V/STOL aircraft to fight current wars.

However, the Marine Corps was not alone in its desire for a fixed-wing, V/STOL aircraft. In fact, the literature from the time as well as the Department of Defense Research and Development budgets spanning the 1960s reflect the importance the Army and Air Force put on the V/STOL debate topic. In the March-April 1956 edition of the Army's *Armor* magazine, an article appeared extolling the potential of V/STOL. *Aviation Week and Space Technology* carried an article in 1960 that covered the Air Force dropping a requirement for a Mach 2 Vertical Takeoff and Landing aircraft and substituting a requirement for a 3,000 foot takeoff, subsonic STOL attack aircraft. According to the article, the Air Force thought they could have the STOL aircraft by 1965 (14 March 1960). Even the Navy was debating the merits of V/STOL as reflected by a 1964 article in the *U. S. Naval Institute Proceedings* updating the progress on V/STOL developments and criticizing the Navy for dragging its feet on the question of V/STOL acquisition.

Despite all the interest in V/STOL, as the 1960s drew to a close, technological progress, especially in the United States ground to a halt. Although Congress had continued to fund Research and Development efforts of V/STOL in the 1950s and 1960s, the combination of the failure to achieve a supersonic V/STOL aircraft, the lack of technological progress and the escalating costs of the Vietnam War caused the Department of Defense to lose interest in the concept. Secretary McNamara, testifying during Senate appropriations hearings to the 90th session of Congress in 1967 stated:

The tests we have conducted have yielded a wealth of new information on the design, capabilities, and problems of V/STOL aircraft, but have not adequately identified a military mission in which a current V/STOL aircraft could be expected to outperform other available aircraft types.¹⁴

This testimony signified the beginning of Department of Defense funding downsizing of V/STOL research and reflected the services' lack of interest.¹⁵

While the other services turned their attention back to conventional aircraft, the Marine Corps kept its focus on its desire for fixed-wing V/STOL. In 1968, based on the

¹⁴U. S. Congress, Senate, *Authorizing Appropriations for FY 1968 for the Department of Defense, Senate Hearings*, 90th Cong., 1st sess., 1967, 150.

¹⁵Although the U.S. Marine Corps continued to be interested in V/STOL, because the Navy pays for all Marine air, the Navy did not request V/STOL Research and Development funding in their budget and the Marines had no recourse.

recommendation of Lt Col John Metzko, Air Weapons Branch, Headquarters Marine Corps, General Keith McCutcheon sent Col Tom Miller and Lt Col Bud Baker to England to test fly the British Harrier. The two pilots flew 20 sorties during September and October 1968, returned to Washington D.C. and conducted a series of briefings on the aircraft. In an article for the *Gazette*, Col Miller described the results of their flight tests.

The unique and exceptional performance exhibited by the Harrier, and the subsequent briefings to the Commandant and the Headquarters Staff, resulted in the decision to rapidly seek approval for procurement of Harrier attack aircraft for the Marine Corps.¹⁶

The efforts of Marines like Colonel Miller, Lt. Col. Baker and General McCutcheon led to the testimony of Secretary of Defense Melvin Laird to the Senate's 1970 Department of Defense Appropriations Hearings that "[t]he Marine Corps is very anxious to acquire a V/STOL fighter aircraft, which would be much less dependant on fixed air bases and which could be used for both close air support and air defense."¹⁷ That testimony was successful, and in 1970 the Marine Corps gave up part of their F-4 buy in order to acquire 12 Harriers.

¹⁶Thomas H. Miller, "Flying the Harrier," *Marine Corps Gazette*, vol. 54 (May 1969): 24.

¹⁷U. S. Congress, Senate, *Authorizing Appropriations for FY 1970 for the Department of Defense, Senate Hearings*, 91st Cong., 1st sess., 1969, 120.

Interestingly enough, this did not cause what may have been an expected furor in the Marine Corps over losing some very capable aircraft for a relative unknown aircraft. Most of the articles and letters in the Gazette from 1969 to 1972 fell into one of three categories. First, writers agreed the Marine Corps needed attack aviation and the Harrier could fill that role. Second, most writers feared that helicopter funding was being cut to purchase more Harriers. Third, even those writers inclined to support the F-4 and its importance to the Marine Corps welcomed the Harrier. For example, Major D. Vest wrote an article entitled "Toward a Fighter Posture for the Seventies," arguing that the Marine Corps needed to be able to perform the fighter mission but maintained that the AV-8A would be able to outperform conventional fighters (Dec 1970). This summed up the theme of most of the articles, that is, they mainly welcomed the Harrier.

CHAPTER 3 BASING FLEXIBILITY

Basing flexibility is the key advantage of the AV-8A. It is expected that the vertical and short takeoff capabilities of the AV-8A will free this aircraft from complex airfields and from catapult and arresting gear for both shipboard and Expeditionary Airfield operations. The AV-8A can operate from air capable ships, conventional airfields, and semi-prepared sites, continuing operations when enemy air or artillery attacks damage the airfield.¹⁸

The Marine Corps has always done a very good job selling itself and the programs it deems important. This stems from the necessity of relying on the Navy for much of its budgeting process. The above quote, while seemingly a typical public relations piece from Headquarters, Marine Corps, is actually an excerpt from a response by the Department of the Air Force to a 1970 Congressional request for a Department of Defense evaluation of the CAS utility of three new aviation weapon systems—the AX, Cheyenne and Harrier. This report, compiled prior to the first AV-8A entering service in the United States, reinforced the Marine Corps' assertion that the Harrier would provide unmatched basing flexibility. When all is said and done, the AV-8 appealed to the Marine Corps as much for basing ease as for its ability as a Close Air Support provider. Due to its expeditionary nature, the Marine Corps has

¹⁸Office of the Commander, USAF to Deputy Secretary of Defense, subject: "Comments as Requested on the Close Air Support Summary Report to be Submitted to Congress, 18 June 1971 (MCRC Archives, Box 5, Aviation, Close Air Support Studies), 68.

developed a host of options with respect to basing its aircraft, both on land and sea. A V/STOL aircraft has the ability to utilize all types of basing within the Marine Corps, albeit better with some of the types than with others. The different options are described below with a brief explanation of how it was envisioned a fixed-wing V/STOL aircraft would be used from it.

Main Air Base

A main air base is a facility which can handle all types and sizes of aircraft, is free from enemy attack and has intermediate level maintenance support located at the site. In such a setting V/STOL aircraft would be able to perform all missions and carry all loads from a main air base.

Air Facility

An air facility is an area that supports a squadron size unit with its associated organic maintenance and ordnance. An air facility is far enough from the front lines that it is safe from enemy interference. V/STOL aircraft have much more flexibility than conventional jets when selecting a site for an air facility. Essentially, it is a compromise between an air base and an air site. Like an air site, it can be set up in an austere location using an existing segment of road or by installing AM-2 matting, yet like an air base, it requires enough space to perform

maintenance and handle the logistics associated with air operations.

Air Site

An air site is an ideal concept for V/STOL because it is a point where a fully armed aircraft can land, close to the ground units, and await its mission. While fueling and limited re-loading may be possible at the air site, the logistical footprint will be kept to a minimum. The flexibility of V/STOL allows a much broader selection of sites than conventional aircraft, few of which in the jet age can operate from anything but a prepared base.

Forward Arming and Refueling Point (FARP)

Primarily, rotary-wing aircraft and C-130s use the FARP. A FARP is extremely close to the front lines and is thus vulnerable to enemy attack. Its use is necessary for rotary-wing in order to greatly reduce its response time for various missions including CAS, medical evacuation, resupply, etc. Because a FARP is very close to, and at times beyond, the front lines, supplying enough ammunition and fuel to support fixed-wing jets can become a major problem. By utilizing an air site, fixed-wing V/STOL have the security of being a bit further behind the front lines, yet still close enough to respond timely with CAS.¹⁹

¹⁹Marine Corps Warfighting Publication (MCWP) 3-21.1, *Aviation Ground Support* (Washington, D. C: United States Government Printing Office, 2001), 3-2, 3-3.

Despite the flexibility V/STOL gives the Marine Corps to use all the above types of basing, there are some drawbacks to each. As early as 1965, an author in the *Marine Corps Gazette* looked past many of the rosy predictions of how flexible a V/STOL aircraft would be and foresaw some of the limitations. James Martz, in an article entitled "Smoke Also Rises" granted that a V/STOL aircraft would be able to operate from short fields; however, he also realized that a tremendous amount of logistics would be required in terms of fuel and ammunition. Additionally, he predicted that the manpower that the Marine Corps was hoping to save by not having to install catapults and arresting gear at its expeditionary fields would be more than offset by the extra number of maintenance personnel necessary to keep a V/STOL jet flying (May 1965). These predictions, while not in line with the thinking of senior Marine leaders, turned out to be very prescient.

Along with land-based flexibility, fixed-wing V/STOL also brings with it sea-based flexibility. It has the ability not only to operate from the conventional, big deck aircraft carriers but from any size deck on which a rotary-wing aircraft operates from: LHA, LHD and LPD. The first helicopter carrier to be built specifically to support the

Marine's concept of an all V/STOL force was the *Iwo Jima* (LPH 2). Work began on this ship in 1959 and she was completed in 1961. The upgrade to the LPH, the LHA (the same type of ship, only larger) was begun in 1968 with the first ship, *Tarawa* (LHA 1), completed in 1976. By the time the Marine Corps had acquired the first AV-8A, the Navy had seven ships (all LPHs) capable of sailing with Harriers aboard.²⁰ An added bonus is the ability, utilized by the British in the Falklands War, to use container and cargo ships to move aircraft. During the Falklands, the British did not have all of their Harriers ready to embark on their aircraft carriers in time to sail down to the area of operations. Therefore, they used the large container ship, *Atlantic Conveyor*, to ferry 14 Harriers—both Sea Harriers and GR3s—to the waiting carriers off the Falklands.²¹

THE NUCLEAR ERA

It is my opinion that future amphibious operations will be undertaken by much smaller expeditionary forces, which will be highly trained and lightly equipped...and movement accompanied with a greater degree of surprise and speed than has ever been heretofore visualized. Or that large forces must be dispersed over a much wider front than used in past operations.²²

²⁰Raymond Blackman, ed., *Jane's Fighting Ships*, (London: Sampson Low, Marston and Co., Ltd., 1967), 353.

²¹Braybrook, 86.

²²K. J. Clifford, *Progress and Purpose: A Developmental History of the USMC 1900-1970* (Washington: History and Museums Division, 1973), 71.

So wrote Lieutenant General Roy Geiger, at the time Commanding General of Fleet Marine Forces, Pacific, to the Commandant after viewing the atomic testing at Bikini Lagoon in the summer of 1946. These tests, the subsequent successful Soviet atomic bomb testing in 1949, and the nuclear arms race that followed caused this nation and others to radically alter their thinking as to how to conduct military operations. Planners believed the World War II model of massing tremendous numbers of forces, equipment and supplies in relatively compact areas had to change. When faced with the devastation of atomic weapons, General Geiger and subsequent planners quickly realized that forces must be dispersed to allow them the ability to survive and to respond.

Immediately following World War II, the United States began a downsizing program within its military. Force levels fell from 3.1 million personnel in 1945 to 391,000 in 1946. While this pace was matched or exceeded by many of the other participants of the war, one country did not follow suit: the Soviet Union. The Soviets continued to maintain a very large army and produce prodigious amounts of war material.²³ Obviously, with relations between the

²³North Atlantic Treaty Organization, *Facts about NATO* (Utrecht, The Netherlands: Bosch, 1957), A1-2.

two countries deteriorating, this military gap needed to be bridged. Nuclear weapons were the answer for the United States. With an initial monopoly on nuclear technology, the United States planned to hold the Soviet Union at bay with a force of nuclear-armed bombers that could threaten Soviet cities. However, as nuclear technology spread and the Soviets developed their own arsenals after 1949 an arms race quickly developed with an associated NATO strategy of the sword and the shield. Simply put, the shield was the forces on the ground in Europe which would absorb, hold and counter-attack the Warsaw pact invasion while the sword—United States strategic forces—retaliated against Warsaw pact cities.²⁴

The challenge then was for NATO countries to develop conventional forces that could survive a massive attack by both conventional and tactical nuclear forces. In order to do this, as pointed out by General Geiger, forces needed to be dispersed. Initially, helicopters offered the greatest potential at least for forward supply and casualty evacuation. However, dispersal was a difficult prospect for fixed-wing aircraft when newer jet-powered planes required thousands of feet of runway to operate from. The solution was foreseen to be V/STOL. As early as 1955,

²⁴*Facts About NATO*, B1-2.

General Cushman, then a Colonel, was writing about the need for aircraft to survive on the nuclear battlefield. In an article for the *Marine Corps Gazette* (April 1955) he propounded the need for "...vertical rising, high performance aircraft..." to operate in the nuclear environment.

As the decade of the 1950s ended, strategic thought on how to best use nuclear weapons began to change. John Foster Dulles summed up the view of the United States government in an excerpt from a 1957 article in *Foreign Affairs*:

The United States has not been content to rely upon a peace which could be preserved only by a capacity to destroy vast segments of the human race. Such a concept is acceptable only as a last alternative...It seems now that [nuclear weapons] use need not involve vast destruction and widespread harm to humanity. Recent tests point to the possibility of possessing nuclear weapons the destructiveness and radiation effects of which can be confined substantially to predetermined targets.²⁵

This line of thought moved from the concept of massive retaliation, where forces everywhere would be subject to devastation, to a more precise level of targeting. For the proponents of V/STOL however, this change did not affect in the least the desirability of a fixed-wing aircraft that did not rely upon major airbases. Such bases would remain

²⁵John Foster Dulles, "Challenge and Response in United States Policy," *Foreign Affairs* vol. 36 (October 1957): 31, quoted in David Schwartz, *NATO's Nuclear Dilemmas* (Washington D. C.: The Brookings Institution, 1983), 51.

prominent targets even under the strategy of more precise targeting.

In the early 1960s, NATO Basic Military Requirement 3 was issued which called for a fixed wing, supersonic, V/STOL strike fighter.²⁶ Despite the fact that a supersonic V/STOL fighter was never realized, the British and the United States Marine Corps were still very interested in a fixed-wing V/STOL aircraft for exactly the reasons put forward in the 1950s.

In 1970 as the Marine Corps was conducting a concept of operations study on the Harrier, the following was included which sums up the utility of V/STOL on the European nuclear battlefield:

...it is envisioned that dispersal to remote sites will be used only when the tactical situation warrants, such as the following:

1. Lack of air superiority renders bases vulnerable to enemy attack.
2. There is a threat of enemy nuclear attacks.
3. The Harrier are supporting landing force units operating on a large front or in a remote action which cannot conveniently be supported from dispersal bases.

The tactical necessity dictates displacing the Harrier forward in close proximity to regiment or battalion to minimize response time.²⁷

²⁶Braybrook, 27.

²⁷Commanding General Marine Corps Development and Education Command report to Commandant of the Marine Corps (Code AX), subject: "2nd Interim Report of USMC Project 54-69-01, AV8A Harrier Concept of Operations Study," 15 September 1970 (MCRC Archives. Research and Development 54-69-01 AV-8A, Box 241, V/STOL Harrier Aircraft Operations Study), 6.

CHEMICAL/BIOLOGICAL THREATS

Vietnam and the Arab-Israeli war have brought home the need for plane dispersal even in non-nuclear battles. Israel managed to destroy most of the Egyptian air force in one fell swoop because, in a surprise attack, it caught enemy planes bunched together on the ground. And in Vietnam, airfields are major targets for ground attack by Communist rocket and suicide teams.²⁸

A corollary to the nuclear threat argument for V/STOL is the chemical and biological threat. Although the above quote does not specifically refer to a chemical or biological attack, the inference can be drawn. One of the goals in achieving air superiority is to deny the enemy the ability to sortie aircraft and interfere with friendly air and ground operations. In order for an enemy of the United States to do this, that enemy must achieve at a minimum one of two objectives; preferably he will do both. The first objective is to destroy our aircraft, either on the ground or in the air. The second objective is to deny us the ability to launch our aircraft. Most times, when considering how to deny someone the ability to conduct air operations, the plan is to destroy his air bases and his aircraft on the ground. However, an alternative is to make the air base and aircraft unusable to him by employing chemical or biological weapons. If a V/STOL aircraft is at the base when it is attacked in this way, it falls into the category

²⁸"Why Marines want to buy British", *Business Week*, 7 June 1969, 12.

of any conventional aircraft—it is unusable until the site is decontaminated. However, if airborne, V/STOL's inherent flexibility allows it to land almost anywhere, allowing the aircraft to be used again in a timely manner.

V/STOL AND THE BIG DECKS

The aircraft carrier and its associated escorts comprise a very powerful instrument of national power. The ability to rapidly move almost anywhere in the world and launch strikes against an enemy makes the carrier an extremely valuable asset. Many missions can be accomplished by the carrier battle group: anti-surface, anti-air, anti-submarine, electronic warfare, deep air support, armed reconnaissance, and close air support. However, because most carrier aircraft are well suited for the role of strategic attack, the Joint Force Commander will often utilize the carrier aircraft in the Joint deep battle. Also, due to the high value of the carrier, if an enemy threat arises, the carrier will be pulled back from that high threat area in order to operate out of harm's way while still influencing the enemy with long range strikes. While this policy is strategically and operationally sound, tactically, for the Marines performing an amphibious assault or holding onto a beachhead, this cautious approach does them little good. In its eyes, the Marine Corps needs

immediate fixed- and rotary-wing CAS as it transitions from ship to shore during an amphibious operation and during the first few days ashore until its artillery and logistics can be off-loaded. By operating from the same ships that the landing force is embarked in, V/STOL aircraft are always on hand, close to the action. Additionally, as will be explored in the next chapter, the pilots are co-located with the ground units aboard the ships allowing for excellent face-to-face briefings and a thorough understanding of the ground scheme of maneuver. In a paper written for the Naval War College, Captain Issac Richardson (United States Navy) contrasts the amphibious groups with the carrier battle groups and sums up why V/STOL is vital to supporting Marines:

The missions of both the ARG [Amphibious Ready Group] and the CVBG [Carrier Battle Group] are quite similar. The difference appears to be in the type of conflict that each is maximized to win. The aircraft carrier was designed to deliver massive air power both on the open ocean as well as in the littoral regions. The ARG was designed to deliver combat troops to a foreign soil...The ARG uses its air power as airborne artillery, close air support, troop delivery, logistics, and air interdiction in support of the land campaign. The carrier uses its air power for power projection and self-defense. Both are the means to an end—mission accomplishment. They just go about the task in a different manner.²⁹

²⁹CAPT Issac Richardson, USN, *Let's Take the CV out of CVBG: Modern Uses for Amphibious Forces for the 1990s and Beyond*, Research Paper (Newport R. I: Naval War College, May 1993), 27.

CHAPTER 4

CLOSE AIR SUPPORT RESPONSIVENESS

CAS is an "air action by fixed- and rotary-wing aircraft against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces." (Joint Publication (Joint Pub) 1-02, *DOD Dictionary of Military and Associated Terms*)³⁰

The Joint Publication definition above is useful to define CAS as it points out one of the very important requirements for CAS—especially for the Marine Corps—detailed integration. However, the definition fails to talk about one of the other very important requirements to make CAS effective and useful for the ground element—timeliness. CAS is something that, to be effective, must be available quickly to the ground forces who need it. There are three ways to make CAS responsive and timely. The first method is to write the Air Tasking Order (ATO) such that a "CAS stack" is always filled. This means that as long as ground operations are being conducted, CAS aircraft are airborne and orbiting close to the front lines. That way, when the ground element needs immediate CAS, it is only minutes away. The drawback to this solution is that it requires a tremendous number of assets

³⁰Marine Corps Warfighting Publication (MCWP) 3-23.1, *Close Air Support*, (Washington, D. C: United States Government Printing Office, 1998), 1-1. Cited hereafter as MCWP 3-23.1.

and can quickly tie up a preponderance of a commander's aviation force.

The second method to provide responsive CAS is to divert airborne aircraft from other missions to support the beleaguered ground unit. There are at least three drawbacks to this type of CAS. First, the response time is not as good as using a "CAS stack". Second, the ordnance carried on the aircraft may not be optimized for a CAS mission. Finally, the mission that the aircraft diverted from still needs to be fulfilled and its absence may affect the larger tactical or operational picture.

The third method of providing timely CAS is to base the CAS aircraft close to the front lines. This is the method most often employed by rotary-wing aircraft. Not only does it allow responsive CAS, forward basing also fulfills the requirement of detailed integration by allowing the pilot to be very close to the ground units. The drawbacks to this method are the need to protect the aircraft and the associated logistics tail that comes with forward basing an aircraft.

Forward deployment of CAS aircraft offers several advantages. Operating from locations close to the battle area can increase loiter time in the objective area, extend effective combat radius, and, perhaps most importantly, make the CAS firepower more responsive to ground commanders by shortening response time. Pre-planned logistic support is vital to ensure that sufficient ammunition, fuel and servicing equipment are in position and ready for use when needed.³¹

Up until the mid 1960s, forward basing of CAS aircraft was only possible utilizing rotary-wing aircraft. During the 1960s, the Marine Corps fielded the OV-10 a propeller driven, fixed-wing aircraft that was capable of performing short takeoffs and landings. However, as mentioned earlier, since as early as 1957 the Marine Corps had envisioned a high performance, V/STOL aircraft that would have the capability to deploy well forward with the helicopters. This debate was carried out in the *Marine Corps Gazette* during the mid 60s. J. M. Verdi foresaw in his article, "Light VMA: A Better Answer," a jet aircraft that was remarkably like the Harrier the Marines eventually bought. His ideal CAS aircraft would operate "...up to Mach .9 at sea level..." and have an "...entirely self contained support system [i.e. the ability to start the engine with no external equipment, unlike the A-4 and other jets that require ground support equipment to start their engines]" (Feb. 1964). This is a logical extension of the basing

³¹MCWP 3-23.1, 3-13.

flexibility argument as the two go hand in hand. An aircraft must have flexibility with respect to where it can operate from in order to operate close enough to the ground units it supports. This lesson was learned in Vietnam where the A-4 Skyhawks were based relatively far away from the Marine ground units they were supporting. Despite the use of CAS stacks, the ground commanders were separated from the aviation element, and the two entities rarely briefed face to face. Consequently, the pilots had little knowledge of the scheme of maneuver or the exact needs of the supported units.³² This practice undercut basic Marine Corps doctrine with its faith in close coordination between ground and air units.

The Marine Corps is organized around the Marine Air Ground Task Force (MAGTF) where aviation is an integrated piece of the combat equation. Marines rely upon aviation as a primary supporting arm. As was mentioned, despite the fact that the A-4 provided excellent support in Vietnam, close coordination was very difficult. As the Marines looked into the problem more closely, the obvious solution which kept rising to top was a fixed-wing V/STOL attack aircraft.

³²Stanley Lewis, "V/STOL CAS in the USMC", *U. S. Naval Institute Proceedings*, no. 102 (October 1976): 113-116.

AMPHIBIOUS ASSAULT

The primary amphibious assault capability of the landing force will consist of fully V/STOL mobile Marine air-ground teams, launched and supported from mission designed amphibious shipping..³³

The above quote is attributed to then Commandant of the Marine Corps, General Wallace M. Greene, in 1965 when he was discussing the Long Range Marine Corps Concept (1975-1985). The importance of Greene's sentiment is two-fold. First, it demonstrates the Marine Corps' early desire for V/STOL. The first GR-1-British version of the AV-8A-would not have its first flight until the end of December 1967, so the Marine Corps was envisioning a force whose capability had not yet been proven. The second striking note was General Greene's recognition that the Marine Corps would not be supporting amphibious operations off large aircraft carriers. As mentioned previously, by the 1950s the aircraft carrier was a very valuable, vulnerable, and expensive piece of equipment. There is a very good probability that effective CAS will not be a mission that will always be high on the list of priorities. However, Marines are almost completely reliant on CAS during the initial stages of an amphibious assault. By having a fixed-wing aircraft that is capable of basing off of, in General Greene's words, "mission designed

³³Clifford, 113.

amphibious shipping", the MAGTF commander is assured he will have dedicated fixed-wing CAS assets to support the Marines who will be storming the beaches.

IF NOT CAS, THEN WHAT?

Fixed-wing, tactical aircraft are always at a premium during war. They provide a commander the ability to prosecute a number of missions that he would not otherwise be able to perform without these assets. He can influence the enemy hundreds—perhaps even thousands—of miles away with minimal effort. He can use the aircraft for armed reconnaissance to feel out where the enemy is located. He can send his aircraft deep to strike the enemy's reserves or formations. He can attack the enemy's lines of communications or infrastructure. He uses his fixed-wing aircraft to provide fighter protection and to attack enemy planes in the air and on the ground. On top of all that, the commander needs to provide close air support to his own forces. As a battle or campaign ebbs and flows, each of the above missions will rise or fall in relative importance to the person in control of the assets.

Based on current joint warfighting doctrine, the Navy and Air Force dedicate their fixed wing sorties to the Joint Force Commander through the Joint Force Air Component Commander. In other words, the two services do not control

which missions their aircraft perform; they support the CINCs needs. For the Army, although CAS is still very important, it can use their impressive numbers of mortars, artillery and attack helicopters to fill most fire support voids.

The Marine Corps has less flexibility. CAS is an absolute requirement for Marine forces. This is because the Marine Corps, in order to remain a light, mobile force, does not rely heavily on indirect fire weapons; instead, it relies upon CAS aircraft. This works well with rotary-wing CAS since attack helicopters, namely the AH-1 Cobra, are designed primarily for that role. Fixed-wing CAS, on the other hand, is another story. Many of the aircraft that provide CAS can also perform other missions equally as well. The Harrier, fortunately for Marines on the ground, does one thing very well-CAS. That is not to say it cannot fly air-to-air missions or armed reconnaissance sorties, but there are other platforms available that do those missions much better and more efficiently. This means the Harrier is available to the MAGTF commander almost exclusively during a conflict, providing him the ability to support his Marines on the ground with adequate fire support.

Immediately before the ground offensive, AV-8Bs conducted intensive operations to prepare the battlefield for ground forces to breach the minefields and obstacle belts in their advance to Kuwait City. AV-8Bs from main bases, amphibious assault ships (LHAs) and unimproved airfields (airfields offering refueling and ammunition with only minor maintenance repair capability) specialized in CAS which required close coordination with Coalition ground forces.³⁴

³⁴Department of Defense Conduct of the Persian Gulf War, Final Report to Congress, Appendix T, subject: "Performance of Selected Weapons Systems," 1992, T-21.

CHAPTER 5

30-YEAR REPORT CARD

From the genesis of V/STOL thinking in the Marine Corps, spawned by General Geiger's 1946 observations, until Secretary of Defense Melvin Laird endorsed it in front of the Senate's 1970 Department of Defense Appropriations Hearings, the Marine Corps worked diligently, but, more importantly, consistently to sell the concept of fixed-wing V/STOL.

Today, we can see how much of this rationale has stood up. By examining the Harrier's performance in the Falklands and Desert Storm, we can understand the validity of the basing flexibility and the CAS responsiveness of the aircraft.

FALKLANDS CAMPAIGN

Due to the relative lack of combat opportunity for the Marine Corps version of the Harrier, it is useful to look at the other major operation the Harrier has been involved in over the last 30 years. When the British made the decision to retake the Falkland Islands from Argentina in 1982, they were faced with the daunting task of engaging an enemy thousands of miles from home with no British land-based facilities. All air power would have to be projected from the sea. To add to their woes, the United Kingdom had

made the decision to give up conventional aircraft carriers; thus, they were forced to rely on fixed-wing aircraft that could take off and land vertically. The Harriers—both the Royal Navy Sea Harrier and the Royal Air Force GR3—demonstrated their basing flexibility. According to the House of Commons Defence Committee Report compiled after the fighting ended,

The campaign provided the opportunity to test in active service conditions the use of Forward Operating Bases (FOBs) which is a feature of the GR3's deployment with RAF Germany. Although the loss of support equipment with the ATLANTIC CONVEYOR, together with communications problems, meant that FOBs could be used for refueling only, the increased time on [station] and the faster reaction capability emphasized the value of this mode of operation. Another useful feature of the Harrier was the ability to make use of converted merchant vessels as holding areas when space was not available on the carriers.³⁵

As in Desert Storm, the aircraft proved its flexibility was a true asset.

Similar to the dilemma faced by the Marine Corps' ground forces, the British forces on the Falklands lacked adequate fire support. The troops ashore, due to amphibious shipping constraints, the terrain that precluded most vehicular movement and the loss of most of their helicopters, relied on a paltry total of 30 105mm light guns.³⁶ Naval surface fire support was used where possible,

³⁵United Kingdom, House of Commons Fourth Report from the Defence Committee, subject: "Implementing the Lessons of the Falklands Campaign," session 1986-1987, 1x.

³⁶Bryan Perrett, *Weapons of the Falkland Conflict* (Poole, Dorset: Blandford Press, 1982), 110.

but the terrain did allow coverage of the entire island and the threat of shore-based Exocet missile attacks and air attacks minimized the contribution of naval gunfire. To fill the fire support void, the British relied upon the Harrier, primarily the Royal Air Force GR3.

During the Battle for Goose Green, British Army Major Chris Keeble was faced with a difficult situation. His unit was running low on ammunition; 35mm anti-aircraft guns were firing at him, and an artillery battery that they could not suppress was harassing them. "The answer, as Keeble saw it, was an immediate air strike, and his requests took on a new note of urgency."³⁷ Three GR3s from Number 1 Squadron answered his call for help by dropping cluster munitions as well as firing rockets. "After [the Harrier's attack] there was a marked slackening in the fighting, which had gone on fiercely the whole day...What is the enemy thinking...Now he was encircled and we had demonstrated that we could bring in the Harriers to attack his positions surgically."³⁸ This vignette is only one of many examples of CAS flown by Harriers to support the victorious British re-occupation of the Falklands.

³⁷Jeffrey Ethell and Alfred Price, *Air War: South Atlantic* (New York: Macmillan Publishing Company, 1983), 131.

³⁸*Air War: South Atlantic*, 132.

DESERT STORM

During multi-aircraft strikes, the Harrier's STOVL [Short Takeoff, Vertical Landing] capability allowed 24 AV-8Bs to recover at their main base at King Abdul Aziz in less than five minutes. The airfield had an unimproved asphalt surface which needed repair, with minimal taxiways and little ramp space...The STOVL capabilities allowed AV-8Bs to continue combat operations when the field was closed to other fixed-wing operations because a disabled aircraft blocked the runway.³⁹

The flexibility demonstrated by the Harrier during the war with Iraq certainly justified the Marine Corps' long standing assertion that a V/STOL aircraft would bring with it unmatched basing flexibility. Not only did Harriers operate from King Abdul Aziz Air Base, but also they flew from the U.S.S. Tarawa (LHA 1) and the U.S.S. Nassau (LHA 4). Additionally, the AV-8Bs sortied out of a Forward Arming and Refueling Point (FARP) located less than 40 miles from Kuwait City. The ability to base so close to the front lines allowed the Harrier to remain on station for extended periods without tapping into seriously over-extended airborne tanking assets.⁴⁰

The forward basing ability of the Harrier was a definite advantage, but the primary reason the Marine Corps needed a fixed-wing V/STOL platform was to increase CAS responsiveness and timeliness. The AV-8B more than proved its worth during Desert Storm. With the aircraft—when

³⁹ "Performance of Selected Weapons Systems", T-22.

⁴⁰ Department of Defense Conduct of the Persian Gulf War, Chapters 1 through 8, April 1992, 237.

operating from the FARP—less than 40 miles from the furthest point of advance at anytime during the war, the Harrier was available for CAS almost immediately. Additionally, the sortie rate for the aircraft was excellent and always available to the ground units in need.

Harriers based at the front of the battle area provided quick response to air requests with effective combat loads. AV-8B missions were not delayed or complicated by air refueling. Missions were flown from LHAs and forward bases to targets in the KTO [Kuwaiti Theater of Operations].

AV-8Bs were effective and responsive in their primary role of supporting ground forces.⁴¹

⁴¹ "Performance of Selected Weapons Systems", T-22, T-23.

CHAPTER 6 CONCLUSION

"The airplane will only be half invented," said Thomas A. Edison, "until it can take off and land without runways."⁴²

In the past 50 years the Marine Corps has been amazingly consistent in explaining why a fixed-wing, jet-powered, V/STOL aircraft is important to the mission of the Marine Corps.

The basing flexibility argument was a logical outcome from the devastation observed during the Bikini Lagoon testing. This line of thinking was further enhanced by the proliferation in the 1950s of nuclear weapons and the threat they posed to large, conventional airbases. An outgrowth of the flexible basing concept was the maturation of the notion that fixed-wing aircraft could successfully operate from non-traditional aircraft carriers.

However, the most important aspect of any weapon system is its ability to accomplish the mission most vital to Marine Corps Aviation. The mission of Marine Corps attack aviation is to provide CAS to Marines on the ground. Starting in the 1950s, the Marine Corps has consistently stated that CAS responsiveness was a priority and that it believed a fixed-wing, V/STOL aircraft was the best

⁴²W. J. Sims, "V/STOL and the USMC," *Marine Corps Gazette*, vol. 49 (May 1969): 25.

solution. General Miller, in his 13 September 1977 press conference, summed up the contribution of the Harrier to CAS:

... from every scenario that we have tried we have been able to reduce that response time to the Marines from what heretofore has been an average of about 30 minutes, we have reduced it into a period of about 5 to 10 minutes. And that is one of the principal reasons of the Marine Corps emphasis on the importance of the Harrier.⁴³

As the Marine Corps moves into the 21st century, it continues with the same, consistent message on V/STOL that has carried them through the previous 50 years. The Corps has insisted on a variant of the Joint Strike Fighter (JSF) that will be STOVL capable. The arguments as to why the Marine Corps needs this capability are the same arguments made in the past. STOVL JSF will give the Marine Corps unmatched basing flexibility and CAS responsiveness.

FUTURE CONFLICTS

Today we focus on Afghanistan, but the battle is broader. Every nation has a choice to make. In this conflict, there is no neutral ground. If any government sponsors the outlaws and killers of innocents, they have become outlaws and murderers themselves. And they will take that lonely path at their own peril.⁴⁴

The war in Afghanistan has demonstrated two realities of future military operations in the war on terrorism. First, aircraft basing and over-flight rights have been and

⁴³Miller, press conference.

⁴⁴"Commander in Chief Gives the Order, Tells the World; Decision to Strike came Saturday; Leaders Informed," *USA Today*, 8 October 2001, accessed on ProQuest, 2 January 2002, A-5.

will continue to be very difficult to come by, especially in some of the remote areas that harbor terrorists. Second, the flexibility and responsiveness of Marine forces afloat make the Marines prime candidates for future operations. As President Bush pointed out in his speech to America on 8 October 2001 announcing the commencement of the war in Afghanistan, the conflict will not end in Afghanistan but will continue against those who harbor terrorists. The press has speculated about which countries are next: Somalia, Iraq, and Yemen to name a few. Basing and over-flight rights are going to be a problem in any of these countries. The one common theme to these areas is their access to the ocean. This will continue to make Marines one of the top choices by military leaders to conduct initial operations in these locations.

Fortunately for today's Marine Corps, visionaries of the 1950s and 1960s have ensured the Corps is presently equipped with the one fixed-wing, jet aircraft capable of rapidly supporting these operations without concern over basing rights. The Harrier is currently being used in Afghanistan, flying off of amphibious ships supporting the forces on the ground. As the United States continues its war on terrorism and targets additional areas of the world

harboring terrorists, the Marine Corps and the Harrier will continue to play a vital role.

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